U.S. Fish and Wildlife Service
Humboldt Bay National Wildlife Refuge
Humboldt County, California

Lanphere Dunes Restoration Photodocumentation

Humboldt Bay National Wildlife Refuge
6800 Lanphere Rd.
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INTRODUCTION

Restoration of the Lanphere Dunes began with the manual removal of European beachgrass (*Ammophila arenaria*) from the foredune zone between 1992 and 1997. The project was funded by The Nature Conservancy and carried out primarily with labor from the California Conservation Corps. Restoration was implemented in three phases, using a patchwork pattern to minimize destabilization. The first phase was implemented between 1992 and 1994, and the last areas (Phase 3) were restored between 1995 and 1997. European beachgrass removal was followed by several years of intensive iceplant (*Carpobrotus* spp.) removal by the U.S. Fish and Wildlife Service. Revegetation was not used in this project, which relied on recruitment and spread from adjacent native vegetation. An annual sweep still occurs to detect and remove any new iceplant and beachgrass.

The photographs on the following pages show the response of the dunes from the start of Phase 1 (1992) or Phase 3 (1995), over the subsequent two decades ending in 2017. Most of the initial photographs were taken at the beginning of Phase 3 (1995), although Photopoint 2 illustrates one area from before restoration began in 1992. Some of the Phase 3 photographic series begin at a point just after beachgrass was removed, and primarily illustrate the recovery of native vegetation. Keep in mind that Phase 3 photographs can include patches of already restored dunes from Phases 1 and 2, so beachgrass appears less continuous than it was in 1992. These time series show how dune morphology and vegetation have continued to evolve.

Photos this page: Restored foredune at the Lanphere Dunes Unit:, with seaside daisy (above) and American dunegrass, beach buckwheat, and beach sagewort (below).

During the 25 year span depicted here, the shoreline experienced cyclic erosion and accretion in response to climate cycles and/or storm activity. An incipient (newly forming) foredune is present in the 1992 and 1995 photographs to the west of the established foredune. The incipient foredune is indicative of a period of relatively calm winters with a positive sediment budget. Extensive shoreline erosion occurred during the 1998-99 La Niña winter, and the incipient foredune is no longer present in the 2001 series. By the time of the 2011 photographs the incipient foredune had reformed. During the winters of 2016 (El Niño) and 2017 the incipient foredune was again partially eroded through a wave cut scarp, although this is not readily visible in the photographs.

The collection of photographs that follows illustrates the return of the dynamic nature of the foredune after overstabilizing European beachgrass is removed. The morphology of some portions of the shoreline are relatively unchanged beyond the cyclic formation and removal of the incipient foredune (Photopoints 1, 2, 3b, 4b), while other areas exhibit the formation or enlargement of blowouts (Photopoints 3a, 6c,11). The most dramatic change occurred at the location of Photopoints 6a and 6b. Following the erosion of the incipient foredune during the La Niña winter of 1999, increased sand transport onto the foredune resulted in swamping of vegetation and the erosion of a stretch of established foredune. The toe of the foredune was replanted with American dunegrass in 2011. Since that time, a new foredune has been evolving, while an incipient foredune has formed and then undergone partial erosion.

Vegetation changes have also been dramatic. Following European beachgrass removal, early successional dune mat species (beach pea, beach morning glory, beach bursage and seaside daisy) recolonized in most areas. American dunegrass was limited due to its relative scarcity at the beginning of the project. Many areas have since shifted to later successional species such as dune goldenrod and beach buckwheat. In addition, American dunegrass has spread along the shoreline and now dominates the incipient and/or established foredune in many places.

Restored foredune at the Lanphere Dunes Unit, with beach buckwheat in the foreground and American dunegrass on both the established and incipient foredunes.

Photopoint 1

Openings in the European beachgrass on the established foredune represent Phase 1 or 2 restored patches. The less densely vegetated incipient foredune visible to the right had not yet been treated.

Native vegetation is returning, especially the colonizing species beach bursage and beach pea, with a few plants of American dunegrass in the foredune. The incipient foredune has eroded.

Photopoint 1 continued

Vegetation cover is more continuous, and beach bluegrass is more common. The incipient foredune is still lacking, and sand is accumulating on the seaward face of the established foredune.

A broad incipient foredune has formed and is dominated by American dunegrass. Species on the established foredune include beach bluegrass, beachbur, American dunegrass, dune goldenrod, yellow sand-verbena, and yarrow.

Photopoint 2

The California Conservation Corps begins removal of dense European beachgrass on the established foredune. There is no incipient foredune present in this area.

Vegetation is much more open and diverse, and is dominated by early successional species yellow sand-verbena, beach bursage, and lesser beach bluegrass and dune buckwheat. Sand is accumulating at the crest of the foredune in the foreground.

Photopoint 2 continued

An incipient foredune built by American dunegrass has formed west of the established foredune. Cover has increased on the established foredune, and beach bursage has been replaced by beach buckwheat.

The incipient foredune is narrower following winter erosion. American dunegrass is now restricted to the incipient foredune where there is active sand deposition. Overall cover has decreased, possibly due to the drought during 2014-15.

Photopoint 3a

This photo was taken just after beachgrass removal in Phase 3, although the incipient foredune to the right was not treated until the next year. The vantage point is from the base of a blowout to the north, visible on air photographs from this period.

The blowout has enlarged and the new photograph is now taken the north rim of the blowout (farther north and east) in order to have a vangatage point from above. The incipient foredune has eroded, reactivating the blowout.

Photopoint 3a continued

The downwind wall of the blowout has become more vertical as the blowout further deflated. However, an incipient foredune has formed, closing the mouth of the blowout.

With increasing stabilization of the incipient foredune, the blowout is less active, and the downwind wall, although still steep, is vegetating.

Photopoint 3b

The immediate foreground of the established foredune was cleared in 1994 and American dunegrass is colonizing. The background area is being treated for the first time. An incipient foredune is present and untreated, but not densely vegetated.

During the 1998-99 La Niña, the incipient foredune was completely removed, and the established foredune was scarped. On the crest of the foredune, native vegetation has colonized, including beach bluegrass, beach buckwheat, beach bursage, and yellow sand-verbena.

Photopoint 3b continued

A broad incipient foredune has reformed and is being colonized primarily by American dunegrass.

The established and incipient foredunes are similar to the preceding photo, however, species diversity on the incipient foredune has increased, especially in the foredune swale.

Photopoint 4b

This area includes some previously treated areas (background, right), while the foreground has just been treated for the first time. The incipient foredune was not cleared until the following year.

Early successional native species have colonized, but cover is still low. The incipient foredune was removed during the 1998-99 La Niña, and the established foredune scarped.

Photopoint 4b continued

The established foredune is now densely vegetated, and a new incipient foredune has been built by American dunegrass.

Species composition on the established foredune has shifted and is now dominated by later successional dune goldenrod. The incipient foredune is still present.

Photopoint 6a

The crest and lee of the foredune just after beachgrass removal in Phase 3. Areas that were treated in earlier phases already have native plants already returning.

A year and a half after the 1998-99 La Niña, a slipface is forming. Although not visible in this photo, the incipient foredune had been removed in this location. Sand is now being transported directly from the beach to the foredune, burying vegetation.

Photopoint 6a continued

This photograph was taken from a different vantage point on the upper beach father west and south of the previous photos, but illustrates that by 2011 the foredune had completely eroded and was devoid of vegetation.

In 2011, the top of the upper beach was planted with 6 rows of American dunegrass. Since that time, an incipient foredune has formed (right) and the foredune is rebuilding (center). The slipface of the transgressive dunefield is now off the photograph to the left.

Photopoint 6b

This photo was taken from the same vantage point as 6A, but to the southeast rather than directly south, showing the lee of the foredune and ridges and swales to the east. Native plants have colonized the Phase 1 and 2 areas.

As shown in the previous photopoint (6A), a slipface has formed and is migrating eastward.

Photopoint 6b continued

The transgressive dunefield has formed and migrated farther east.

Although the eastern portion of the dunefield is still migrating, the rate of migration has slowed. American dunegrass and other dune mat species are colonizing the dunefield.

Photopoint 6c

The established and incipient foredune, taken just after beachgrass removal in Phase 3. Native vegetation in the centerground has returned in a small area treated in earlier phases.

Native plants have vegetated the seaward face of the foredune, with an open area of blowing sand now on the lee face (lower right). The incipient foredune has eroded.

Photopoint 6c continued

The foredune has accreted to the west, although not as a distinct incipient foredune. The open area in lower right is now the upwind end of a blowout.

The foredune has increased in height as vegetation cover on the shoreward face has increased in density. The blowout area is still present in lower right.

Photopoint 11

Phase 3 removal had just occurred when this photo was taken, although European beachgrass was still present on the incipient foredune.

The foredune is covered by some native species (beach pea and beach morning glory) with several large plants of sea rocket, a non-native species that doesn't persist after restoration. The incipient foredune was removed during the 1998-99 La Niña.

Photopoint 11 continued

The foredune has become largely colonized by American dune grass. An inipient foredune is reforming, and a blowout has developed in the middle-ground behind the foredune crest.

American dunegrass continues to dominate the foredune crest. The incipient foredune is broader but not densely vegetated. The blowout in the centerground has continued to develop.